Study Regarding Rumination Behavior in Cattle – Position Adopted by Cows During Rumination Process

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Abstract

Aim of this research was to describe some aspects regarding the position adopted by lactating dairy cows during rumination process. Researches were carried out on 20 multiparous Romanian Black and White cows, housed in total confinement in a tied stanchion barn. Cows were in their first 100 days of lactation. During current study the rumination position adopted by cows (lying or standing) and time spent ruminating was registered (by means of total duration, time length of a rumination period and number of ruminating periods) per 24 h and on day segments. Position adopted by cows while ruminating was compared between summer and winter seasons, using video material recorded using a professional system CC9622BIR with four channels and a capacity of 125 frames per second. During winter season, cows spent ruminating per 24 h on average 186.35 minutes (3.10 hours) in standing position and 324.05 (5.40 hours) minutes while lying. In the summer season, cows adopted standing position during the rumination process on average 225.35 minutes (3.75 hours) and 176.45 (2.94 hours) minutes while lying down. Season had little influence on the standing position during rumination (39 minutes, $p>0.05$), but influenced significantly the lying down time during rumination (147.60 minutes, $p<0.001$).

Keywords: cattle behavior, dairy cows, Romanian Black and White, rumination process

1. Introduction

Rumination process in dairy cows usually represents 25-35% of a days interval, position adopted by cows while ruminate is important and could serve in order to assess the level of comfort offered to the animal.

Motives for witch cow change their positions are diverse. Cows adopt standing position usually in order to consume forages, to drink water, to defecate and urinate, when disturbed by humans, during milking time and sometimes for rumination. When lying, cows prefer to rest, ruminate and sleep, although sleep in cattle can take place in standing position. On average, during 24 h interval 16 alternations between standing-lying positions are registered.

Factors that influence position adopted by cows during rumination are: bedding material quantity and quality, daily activities and program, environmental factors, health of the animals, age and body weight, time spent feeding etc.

When lying, a cow organism benefits because the feet pressure is lower, and at the mammary gland the blood circulation intensifies with 20% and the lameness affects are lower.

2. Materials and methods

In the current study twenty multiparous Romanian Black and White cows were used.

The cows were housed in a tied stanchion barn at the Didactical Farm of the Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara. The experiments were carried out during winter and summer seasons, each experimental group consisted in 10 lactating cows.

Cows monitored were in their first 100 days of lactation, and had an average daily yield of 15.7 liters the first group (winter season) and of 20.5 liters second group (during summer season). And a mean body weight of the cows of 617 kg during first experiment,

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and 581.6 kg the animals that were monitored during summer season.

During the first experimental period, cows were fed a diet consisted in 20 kg of corn silage, 8 kg of pasture hay, 3 kg of concentrates and 4 kg of brower yeast. In summer season, cows received a diet of 30 kg alfalfa fresh feed, 3 kg of concentrates and 4 kg of brower yeast. The forages were offered to the animals in two equal portions each day, at approximately 6:30 and 16:30.

The cows were milked twice a day, at approximately 5:00 and 17:00 h. Data regarding environmental temperature was recorded three times per day, at 7:00, 14:00 and 23:00 h. The average air temperature registered inside the barn was 8.1°C during winter and 28.4°C in the summer. Cows had free access to a water source 24 h. As bedding material, approximately 4 kg of wheat straws per animal and day were used.

Drinking behavior was monitored 24 h, using 4 video cameras (CC9622BIR) connected to a vide capture device of 125 frames per second with four channels. Video recordings were analyzed by continuous observation for each cow and each period. For a better interpretation of the results, the 24 h interval was divided in three segments.

In our research we have registered and studied position adopted by cows during the two experimental seasons during rumination process.

3. Results and discussion

Averages, dispersion indices, differences and their significance for the position adopted by cows during rumination periods in the winter season are presented in table 1.

Cows spent ruminating during the variant with two meals per day, on average 157 minutes in standing position (10.9% from 24 h) and 318.3 minutes in lying position (22.1% from the days interval). Also, during the segments of the day, cows preferred to ruminate in lying down position, compared to standing position.

During the experimental variant in winter, with the administration of the forages in three meals per day, cows spent ruminating on average 215.7 minutes standing (14.9% from 24 h) and in lying position they ruminate, on average 329.8 minutes (representing 22.9% from the day).

On 24 h, between the two experimental variants, for both standing and lying position adopted while ruminating, differences registered are insignificant statistically ($p>0.05$). Results show that the number of meals per day influences little the position adopted by cows during rumination process during winter season.

Between the segments of the day, in both experimental variants, have been registered significant differences ($p<0.05$) only during segments II. For rumination in standing position differences were of 34.5 minutes, and for rumination in lying down position of 27.8 minutes.

Averages, dispersion indices, differences and their significance for the position adopted by cows during rumination periods in the summer season are being presented in table 2.

When cows were offered the ration in two meals per day, they ruminated in standing position on average for 220.9 minutes (15.3% from 24 h) and in lying position 129.7 minutes (9% from the day's interval).

When forages were offered three times per day, cows spent ruminating in standing position in 24 h, on average 229.8 minutes (15.9% from 24 h) and in lying position for 223.2 minutes (15.5% from 24 h).

It can be observed that during summer experiment, cows preferred to ruminate in standing position, comparative to the winter season, when they preferred the lying position. This may due to the fact that during summer experiments, temperatures were high, and cows attempted to thermo regulate they bodies by standing us and using the air current for cooling.

For rumination in standing position, between the two experimental variants, the differences registered among the days segments were insignificantly statistic ($p>0.05$).

For rumination in lying down position, between the two experimental variants, for 24 hours interval, differences registered were of 95.5 minutes, the difference being statistically significant ($p<0.05$).

Averages, dispersion indices, differences and their significance for the position adopted by cows during rumination periods in winter and summer seasons are presented in table 3.

On 24 h, during winter season cows spent ruminating on average 186.3 minutes in standing position (12.9% from 24 h) and for 324 minutes in lying position (22.5% from 24 h). During summer season, cows spent ruminating on average for 225.3 minutes in standing position (15.6% from 24 h interval) and 176.4 minutes in lying position (12.2% from 24 h).

For rumination in standing position, differences registered were insignificant statistically for both 24 h interval and days segments ($p>0.05$).

For rumination time in lying position, differences registered between the first two segments of the day were insignificant statistically, only the differences between the night segments (III) of 121.5 minutes were significant ($p<0.001$).

Differences registered between the 24 h interval were on average of 147.6 minutes in favor of the winter season, difference very significant statistically ($p<0.001$).

Table 1 Position adopted by cows during rumination in winter season (minutes)

Winter season		Ration in 2 meals/day		Ration in 3 meals/day	
		Standing	Lying	Standing	Lying
Segment I 7-14 h	$X \pm S_x$	31.30±8.71	57.50±10.60	41.30±13.11	55.10±11.90
	SD	27.54	33.53	41.46	37.65
	cv (%)	88.00	58.32	100.39	68.33
	from 420 min	7.45%	13.69%	9.83%	13.11%
Segment II 14-21 h	$X \pm S_x$	44.40±10.29	53.90±8.97	78.90±7.52	26.10±7.19
	SD	32.56	28.38	23.78	22.76
	cv (%)	73.33	52.66	30.14	87.21
	from 420 min	10.57%	12.83	18.78%	6.21%
Segment III 21-7 h	$X \pm S_x$	81.30±22.92	206.90±29.58	95.50±32.59	248.60±34.93
	SD	72.48	93.57	103.09	110.48
	cv (%)	89.16	45.22	107.95	44.44
	from 600 min	13.55%	34.48%	15.91%	47.43%
Total 24 h	$X \pm S_x$	157.00±35.38	318.30±41.05	215.70±49.24	329.80±50.44
	SD	111.91	129.81	155.72	159.52
	cv (%)	71.28	40.78	72.19	48.37
	from 1440 min	10.90%	22.10%	14.97%	22.90%
Differences registered				Standing	Lying
2 meals - 3 meals/day		Segment I		- 10 ^{ns}	2.40 ^{ns}
		Segment II		- 34.5 *	27.80 *
		Segment III		- 14.20 ^{ns}	- 41.70 ^{ns}
		On 24 h		- 58.70 ^{ns}	- 11.50 ^{ns}

Table 2 Position adopted by cows during rumination periods in summer season (minutes)

Summer season		Ration in 2 meals/day		Ration in 3 meals/day	
		Standing	Lying	Standing	Lying
Segment I 7-14 h	$X \pm S_x$	47.90±9.75	21.30±5.57	64.30±19.23	41.70±12.16
	SD	30.85	17.62	60.84	38.48
	cv (%)	64.41	82.72	94.62	92.28
	from 420 min	11.40%	5.07%	15.30%	9.92%
Segment II 14-21 h	$X \pm S_x$	63.50±10.47	31.70±10.13	67.80±16.78	45.80±11.86
	SD	33.11	32.04	53.07	37.52
	cv (%)	52.14	101.08	78.27	81.92
	from 420 min	15.11%	7.54%	16.14%	10.90
Segment III 21-7 h	$X \pm S_x$	109.50±15.25	76.70±9.11	97.70±14.47	135.70±17.43
	SD	48.23	28.82	45.78	55.13
	cv (%)	44.05	37.57	46.86	40.62
	from 600 min	18.25%	12.78%	16.28%	22.61%
Total 24 h	$X \pm S_x$	220.90±28.10	129.70±17.99	229.80±44.45	223.20±39.19
	SD	88.88	56.89	140.57	123.94
	cv (%)	40.23	43.86	61.17	55.53
	from 1440 min	15.34%	9.00%	15.95%	15.50%
Differences registered				Standing	Lying
		Segment II-III		- 29.90 ^{ns}	- 89.90**
2 meals - 3 meals/day		Segment I		- 16.40 ^{ns}	- 20.40 ^{ns}
		Segment II		- 4.30 ^{ns}	- 14.10 ^{ns}
		Segment III		11.80 ^{ns}	- 59 *

	On 24 h	- 8.90 ns	- 93.50 *

Table 3 Averages, dispersion indices, differences and their significance for the position adopted by cows during rumination periods in winter and summer seasons (in minutes)

Time period		Winter season		Summer season	
		Standing	Lying	Standing	Lying
Segment I 7-14 h	$X \pm S_x$	36.30±7.74	56.30±7.76	56.10±10.66	31.50±6.92
	SD	34.36	34.72	47.69	30.95
	from 420 min	8.64%	13.40%	13.35%	7.50%
Segment II 14-21 h	$X \pm S_x$	61.65±7.35	40.00±6.44	65.65±9.63	38.75±7.76
	SD	32.91	28.81	43.10	34.71
	from 420 min	14.67%	9.52%	15.63	9.22%
Segment III 21-7 h	$X \pm S_x$	88.40±19.46	227.75±22.78	103.60±10.32	106.20±11.72
	SD	87.03	101.91	46.16	52.43
	from 600 min	14.73%	37.95%	17.26%	17.70
Total 24 h	$X \pm S_x$	186.35±30.26	324.05±31.67	225.35±25.61	176.45±23.56
	SD	135.37	141.66	114.55	105.40
	from 1440 min	12.94%	22.50%	15.64%	12.25%
Differences winter-summer		Time period		Standing	Lying
		Segment I		- 19.80 ns	24.80 ns
		Segment II		- 4 ns	1.25 ns
		Segment III		- 15.20 ns	121.55 ***
		On 24 h		- 39 ns	147.60 ***

4. Conclusions

During winter season, cows prefer to ruminate in lying position (324 minutes) compared to standing position (186.3 minutes). From entire time spent ruminating, cows ruminate in lying down position 63.4%, and only 36.5% in standing position.

A very different situation has been registered during summer season, when cows spent ruminating in standing position 56% and only 43.9% in lying position. This may due to the fact that during summer, high temperatures may have led to the installing of heat stress, and by this manner the animals were trying to thermo regulate their body temperatures.

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References

1. Acatincai, S., Gavojdian, D, Cziszter, L., T., Tripon, I., Alungei, A., Popian, C., Study regarding rumination behavior in multiparous Romanian Black and White cows during summer season, Scientifical papers, Animal Science and Biotechnologies, 2009, 42 (2), 191-195,

2. Herlin, H. A., Bridgit, F., Effects of protective gates at concentrate feed stations on behavior and production in dairy cows, Appl. Anim. Behav. Sci., 2007, 103, 167-173,

3. Huzzey, J. M., von Keyserlingk, M. A. G., Weary, D. M., Changes in Feeding, Drinking and Standing Behavior of dairy cows during transition period, J. Dairy Sci., 2005, 88, 2454-2461,

4. Matzke, W. C., Behavior of large groups of lactating dairy cows housed in a free stall barn – M.S. Thesis, 2003, Univ. of Nebraska, Lincoln.